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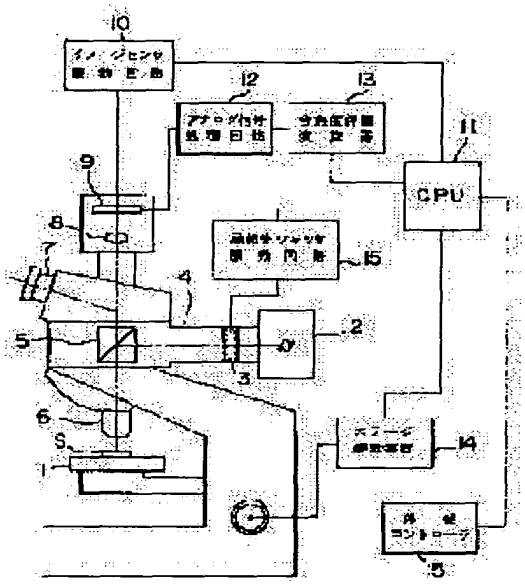
(54) AUTOMATIC FOCUS DETECTOR FOR MICROSCOPE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an automatic focus detector capable of speeding up and accuracy improvement in automatic focusing(AF control) to an observation sample at the time of fluorescent observation with an AF device loaded on a microscope.
SOLUTION: In front of a mercury vapor lamp 2 deviating from an optical path from an object lens 6 to an eyepiece 7 or an image sensor 9, an excitation light shutter 3 for interrupting excitation light with which an object is irradiated is provided. In this case, by a CPU 11, an AF control system and the excitation light shutter 3 are linked, and before performing the AF control, corresponding to the difference of the output of only stray light in the closed state of the excitation light shutter 3 and the output in the open state, the object is searched and focus adjustment is performed in excess of the level of the stray light in the case that the difference is less than a prescribed value, and the focus adjustment is performed directly in the case that the difference is more than the prescribed value.



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CLAIMS

[Claim(s)]
[Claim 1] Automatic-focusing detection equipment for microscopes characterized by providing the following. Two or more objective lenses. The stage loading the observation sample used as a photographic subject. The focusing mechanism in which the relative distance of the aforementioned objective lens and the aforementioned stage is adjusted. The image formation optical system to which image formation of a photographic subject's image is carried out through the aforementioned objective lens, and the light source for excitation light which irradiates excitation light to the aforementioned photographic subject, The excitation optical shutter which forbids irradiating the aforementioned excitation light at a photographic subject, and the found the integral type image pck-up sensor which changes the light figure from the aforementioned image formation optical system into an electrical signal, An operation means to calculate a photographic subject's degree of focus according to the output from the aforementioned found the integral type image pck-up sensor, A stray light output means to obtain the output of the aforementioned found the integral type image pck-up sensor in the state where the aforementioned excitation optical shutter was closed, the aforementioned excitation optical shutter -- opening -- the stray light which computes the difference of the output of the aforementioned found the integral type image pck-up sensor in a state, and the output of the aforementioned stray light detection means the bottom -- difference -- with an output means the degree information of photographic subject focus by the aforementioned operation means, and the aforementioned stray light -- difference -- the stray light from an output means -- difference -- the focus control means controlled to make the aforementioned focusing mechanism drive based on information, and to lead the aforementioned photographic subject to a focus position
[Claim 2] the reference level as which the aforementioned focus control means were determined beforehand, and the aforementioned stray light -- difference -- the difference from an output means -- an output -- comparing -- the above -- difference, when an output is large focus operation -- carrying out -- the above -- difference, when an output is small The reset time of the aforementioned found the integral type image pck-up sensor is set as the value beforehand set up according to the classification of the aforementioned objective lens. Automatic-focusing detection equipment for microscopes according to claim 1 characterized by returning the aforementioned reset time and performing focus control after the aforementioned difference partial output drove the aforementioned focusing mechanism in the position exceeding the aforementioned stray light signal level.
[Claim 3] A search entry means by which the range which searchs a photographic subject beforehand can be set up in the aforementioned automatic-focusing detection equipment for microscopes, When the search out-of-range shell AF set up with the aforementioned search entry means is started, a high-speed stage move means to drive a stage to a search range edge at high speed is provided further. by the aforementioned high-speed stage move means after arriving at the search range edge defined beforehand -- the aforementioned stray light output means and the aforementioned stray light -- difference -- the claim 1 characterized by performing control action by the output means and the aforementioned AF control adjustable means, or the automatic-focusing detection equipment for microscopes according to claim 2

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the automatic-focusing detection equipment carried in the optical instrument which performs fluorescence observation, especially a microscope.
[0002]
[Description of the Prior Art] Conventionally, it crosses in many fields, new technology is proposed, and the auto-focusing (AF) equipment of an optical instrument incorporates a photographic subject image in it, and has the so-called passive method which doubles a focus from the dotage condition of the image.
[0003] On the other hand, as the photographic subject image observation method of a microscope, excitation light is addressed to a photographic subject, there is a method of observing the feeble fluorescence image which the photographic subject which did fluorescent staining emits, and since there is much amount of information acquired, the opportunity using fluorescence observation as the inspection method is increasing.
[0004] Tenebrescence is raised as one feature of this fluorescence observation. The tenebrescence of a sample shows that the power of the light of the fluorescence which a sample emits [the sample which carried out fluorescent staining] by irradiation of excitation light declines. Attenuation of this light is proportional to x (excitation luminous intensity) (excitation light irradiation time). For this reason, a speculum person needs to shorten time to irradiate excitation light at a sample as much as possible.
[0005] AF equipment for microscopes is one of the indispensable functions, in order to automate inspection by this fluorescence observation, and the needs of the microscope AF equipment for fluorescence observation are becoming high. The following performances are thought as important from the above point by the microscope AF equipment for fluorescence observation.
[0006] 1) Since the fluorescence which a photographic subject emits is weak, the sensor which incorporates a photographic subject image should be high sensitivity.
2) Since time for a photographic subject to emit light is short (tenebrescence is carried out), be high-speed.
[0007] 3) In order to raise the reliability of inspection, it is a high focus precision. For example, the reset time in the case of incorporating a photographic subject image using a found the integral type photo detector is controlled by the focal detection equipment in JP,54-45127,A according to the luminosity of a photographic subject image, and the method of raising the sensitivity on appearance is indicated.
[0008] Moreover, in JP,59-154880,A, in order to incorporate the light figure from a photographic subject image with a sufficient precision, the shutter in front of a shading pixel or a sensor is used, and the method of removing noise light is indicated.
[0009]
[Problem(s) to be Solved by the Invention] There are the following troubles in the conventional method mentioned above. Since the so-called stray light which a surrounding lighting light etc. mixes in the light figure which carries out incidence from an objective lens, and which carries out image formation on a sensor other than the light figure from a photographic subject image has arisen when the conventional technology is applied to a microscope as it was, it is inapplicable at the time of fluorescence observation of a microscope.
[0010] This stray light is explained with reference to drawing 6 . Drawing 6 is drawing having shown in detail the optical path of the microscope used for fluorescence observation. Originally, the optical path of a microscope passes the incident light fluorescence medication pipe 24 from the light sources 22, such as a mercury lamp shown as a solid line, and is irradiated by the photographic subject S, and a photographic subject's S fluorescence image is inputted into image sensors 29 through an objective lens 26.
[0011] However, the light actually inputted into image sensors 29 has some which are mixed from a different path from an original path. As the example, the stray light by the path of the dashed line A in drawing is shown. When a microscope suits indoors, lighting light, such as an indoor fluorescent lamp, will input this stray light into image sensors 29. That is, an indoor lighting light reflects in a stage 21 and a photographic subject's S slide glass, and inputs into image sensors 29 through an objective lens 26. In addition, as a dashed line B shows, it may input into image sensors 29 through an ocular 27.
[0012] Although such the stray light is weaker than the intensity of a photographic subject's fluorescence, microscope automatic-focusing detection equipment will start a malfunction to the threshold used as the base by the stray light as the fluorescence output from the photographic subject S from the first shows with the dashed lines A and B in eye a feeble hatchet and this drawing. Moreover, when the photographic subject image is fading in fluorescence observation, the stray light and distinction of the photographic subject image inputted into image sensors become still more nearly impossible.

[0013] For example, since it will become long about the reset time more than required in order to double the reset time of a sensor and will become longer than actually required incorporation time after the aforementioned stray light has entered in the process which searchs a photographic subject if the focal detection equipment indicated by JP,54-45127,A is applied to fluorescence observation, focus speed falls remarkably.
[0014] Moreover, in JP,59-154880,A, even if it uses the shutter in front of a shading pixel or a sensor, removal of the stray light which enters from an objective lens like a regular photographic subject light figure is impossible. Moreover, since the stray lights differ for every surrounding situation or microscope itself to be used, they cannot remove a part for the stray light beforehand, either.
[0015] Then, this invention aims at offering the automatic-focusing detection equipment for microscopes which makes the improvement in the speed and highly-precise-izing in the auto-focusing (AF control) to an observation sample at the time of fluorescence observation realize in AF equipment carried in a microscope.
[0016]
[Means for Solving the Problem] The stage loading the observation sample used as two or more objective lenses and a photographic subject in order that this invention may attain the aforementioned purpose, The focusing mechanism in which the relative distance of the aforementioned objective lens and the aforementioned stage is adjusted, The image formation optical system to which image formation of a photographic subject's image is carried out through the aforementioned objective lens, and the light source for excitation light which irradiates excitation light to the aforementioned photographic subject, The excitation optical shutter which forbids irradiating the aforementioned excitation light at a photographic subject, and the found the integral type image pck-up sensor which changes the light figure from the aforementioned image formation optical system into an electrical signal, An operation means to calculate a photographic subject's degree of focus according to the output from the aforementioned found the integral type image pck-up sensor, A stray light output means to obtain the output of the aforementioned found the integral type image pck-up sensor in the state where the aforementioned excitation optical shutter was closed, the aforementioned excitation optical shutter — opening — the stray light which computes the difference of the output of the aforementioned found the integral type image pck-up sensor in a state, and the output of the aforementioned stray light detection means the bottom — difference — with an output means the degree information of photographic subject focus by the aforementioned operation means, and the aforementioned stray light — difference — the stray light from an output means — difference — the aforementioned focusing mechanism is made to drive based on information, and the automatic-focusing detection equipment for microscopes equipped with the focus control means controlled to lead the aforementioned photographic subject to a focus position is offered
[0017] The automatic-focusing detection equipment for microscopes constituted as mentioned above It separates from the optical path from the optical path, i.e., the objective lens, of image formation optical system to an ocular or a found the integral type image pck-up sensor. Have the excitation optical shutter which intercepts the excitation light irradiated by the photographic subject ahead of the light source for excitation light, interlock a focusing mechanism and an excitation optical shutter, and the difference partial output from a stray light difference partial-output means is measured as the reference level defined beforehand. According to the classification of the objective lens equipped with the reset time of a found the integral type image pck-up sensor when an output was small, it is set as the value set up beforehand. difference — case an output is large — focus operation — carrying out — difference — After difference partial output drives a focusing mechanism in the position exceeding stray light signal level, the reset time is returned and focus control is performed.
[0018]
[Embodiments of the Invention] Hereafter, with reference to a drawing, the operation gestalt of this invention is explained in detail. The rough example of composition of the automatic-focusing detection equipment for microscopes concerning the 1st operation gestalt by this invention is shown in drawing 1 , and it explains to it.
[0019] The optical system of this operation gestalt for irradiating excitation light for the stage driving gear 14 which a photographic subject S is laid [driving gear], moves the stage 1 movable in the vertical direction, and a stage 1 in the vertical direction, and makes a photographic subject S focus, and a photographic subject S for example A mercury-vapor lamp 2 and the excitation optical shutter 3 which can interception control the aforementioned excitation light irradiated to a photographic subject, The incident light fluorescence floodlighting pipe 4 to which the aforementioned excitation light irradiated to a photographic subject is led, and the cube corner reflector 5 which passes the fluorescence picture which the aforementioned excitation light was made refracted in an objective lens 6 side, and was further emitted from the aforementioned photographic subject S, The ocular 7 for branching and a speculum person observing the fluorescence picture emitted from the aforementioned photographic subject S, The image formation lens 8 for the automatic-focusing detection equipments for focus control, and the image sensors 9 which receive and carry out photo electric translation of the fluorescence picture by which image formation was carried out, The image-sensors drive circuit 10 which outputs the driving pulse used as the timing which carries out photo electric translation to image sensors 9 so that the dynamic resin of the analog processing circuit 12 may be made to suit by control of CPU11, CPU11 which controls each composition section, and the analog processing circuit 12 which performs predetermined processing to a picture signal from image sensors 9, It consists of a degree evaluation computing element 13 of focus which performs an evaluation operation according to the operation expression specified from CPU11, and an excitation optical shutter drive circuit 15 which makes the excitation optical shutter 3 open and close by control of CPU11.
[0020] Thus, the excitation light from a mercury-vapor lamp 2 is led to the optical system of this constituted operation gestalt through the excitation optical shutter 3 by the photographic subject S loaded into the stage 1

at the incident light fluorescence floodlighting pipe 4, it is further refracted by the cube corner reflector 5, passes an objective lens 6, and is irradiated by the photographic subject S.
[0021] The fluorescence picture emitted from the aforementioned photographic subject S passes an objective lens 6, a speculum person observes a part through an ocular 7, image formation of the part is carried out with the image formation lens 8 for the automatic-focusing detection equipments for focus control, and it is projected to image sensors 9.
[0022] By control of CPU11, the image-sensors drive circuit 10 outputs a driving pulse to image sensors 9 so that the dynamic resin of the analog processing circuit 12 may be made to always suit, and image sensors 9 change the picture which received light to the timing according to the inputted driving pulse into an electrical signal.
[0023] The picture signal changed into the electrical signal by these image sensors 9 receives processing predetermined in the analog processing circuit 12, and is sent to the degree evaluation computing element 13 of focus. The aforementioned degree evaluation computing element 13 of focus performs an evaluation operation according to the operation expression specified from CPU11, and sends a result to CPU11. By sending a control signal to the stage driving gear 14 based on the result of the degree evaluation operation of focus, and moving a stage 1 in the vertical direction, it consists of CPUs11 so that the relative distance of a photographic subject S and an objective lens 6 may be adjusted and an automatic focus may become possible.
[0024] Moreover, CPU11 outputs a shutter keying signal to the excitation optical shutter drive circuit 15 if needed, and can open now and close the excitation optical shutter 3. And the external controller 15 is equipment which has the switch used in order that a **** person may control the electric section part of a microscope, and a jog dial, and if a **** person performs operation of the start of automatic-focus operation, an end, etc. using the external controller 15, since it will send the information to CPU11, it has composition with CPU11 able to perform operation according to operation.
[0025] Moreover, when the pronunciation member is built in the external controller 15, for example, a success/failure in AF control operate a pronunciation member, transmitting to a speculum person is possible.
[0026] An operation is explained to this operation gestalt which prevents the malfunction by the stray light mentioned above with reference to the flow chart shown in drawing 2 . First, if the start of AF operation is directed based on operation of an operator (Step S1), the excitation optical shutter drive circuit 15 will drive, and the excitation optical shutter 3 will be closed (Step S2).
[0027] And when the excitation optical shutter 3 is a closed state, the level A of the stray light which carries out incidence from an objective lens 6 or an ocular 7 is detected (Step S3), next the excitation optical shutter 3 is opened (step S4), and the photographic subject picture signal B in which the stray light is also contained is detected (Step S5).
[0028] and the level A of the stray light and difference with the photographic subject picture signal B — C is taken (Step S6) This difference partial output C judges whether they are one or more predetermined values TH defined beforehand (Step S7). By this judgment, when the difference partial output C is one or more TH(s), (YES) and a photographic subject judge that it is in near, and perform a double lump of a focus.
[0029] A double lump of this focus detects the contrast of a photographic subject image (Step S8), detects the stage position where this contrast serves as the maximum (step S9, S10), and ends AF control.
[0030] However, by the judgment of Step S7, when the difference partial output C is one or less predetermined value TH, (NO) and a photographic subject are judged that there is nothing to near, and perform a photographic subject search. It sets to this photographic subject search, and first, to the reset time T1 found when the stray light was detected, from a half, the reset time of the image sensors at the time of stray light detection is set as the about 1/4 short reset time T2, and is performed (Step S11). And the search of a sample performs the stage drive which a photographic subject signal serves as level enough exceeding the stray light, namely, exceeds enough stray light output A' in the reset time T2 by which a photographic subject signal is computed from the relation between the stray light output A and the reset time T2 (Steps S12-S14). After this sample search is completed, it shifts to Step S8, a focus doubles, and lump control is performed.
[0031] According to this operation gestalt, only the stray light inputted into image sensors is detected at the time of AF start, and since a part for the stray light is removable from the photographic subject light figure which contains the detected stray light after that, search operation of a photographic subject can judge certainly in the need.
[0032] Moreover, since the integral control of image sensors is not carried out according to the stray light since the output of the stray light is known at the time of a search, and the reset time can be shortened, the focus speed by shortening of the time which a search takes improves.
[0033] Moreover, although stray light detection by the excitation optical shutter 3 is performed with this operation gestalt, even if it lowers the output of the excitation light light source itself for this or arranges a shutter style in an incident light floodlighting pipe, it is possible to acquire the same effect.
[0034] Moreover, although the so-called AF control of the mountain-climbing servo system which detects the maximum contrast position of a photographic subject image is performed in this invention, this is applicable also to AF control of an optical-path-difference method etc.
[0035] Next, the microscope automatic-focusing detection equipment concerning the 2nd operation gestalt is explained. The composition of this operation gestalt is equivalent to the 1st operation gestalt mentioned above, since operations differ, the explanation about composition is omitted here and the sample search entry used as the feature is explained.
[0036] In this operation form, a sample search entry function is a function to be able to set up the stage vertical

range which should search slide glass and the sample thick shell sample which a **** person uses beforehand, to avoid that focal detection equipment carries out a sample search for all the movable ranges of a stage, and to shorten focus time.

[0037] With reference to the flow chart shown in drawing 3 , the operation of automatic-focusing detection equipment which has such a function is explained. In addition, in an operation equivalent to the step of the 1st operation form mentioned above, the same step number is attached, and detailed explanation is omitted.

[0038] First, if the start of AF operation is directed based on operation of an operator (Step S1), the stage position which has stopped the present stage 1 will judge in sample search within the limits defined beforehand (Step S21).

[0039] If a stage position is in a sample search in this judgment (YES), like the 1st operation gestalt mentioned above, it will shift to Step S2 and the stray light will be detected. however, a stage position -- a sample search -- if out of range, it will move to a sample search range edge at (NO) and high speed (Step S22) And after moving to a search range edge, it shifts to Step S2 and the excitation optical shutter 3 is closed (Step S2).

[0040] and the level A of the stray light according [the excitation optical shutter 3] to a closed state -- detecting -- subsequently -- the excitation optical shutter 3 -- an open state -- the photographic subject picture signal B -- detecting -- the level A of the stray light, and difference with the photographic subject picture signal B -- C is taken (Steps S3-S6) This difference partial output C is compared with the predetermined value TH1, and when the difference partial output C is one or more TH(s), a double lump of a focus is performed (Steps S8-S10). However, when the difference partial output C is one or less predetermined value TH, after (NO) and a photographic subject are judged that there is nothing to near and perform a photographic subject search (Steps S12-S14), a double lump of a focus is performed (Steps S8-S10).

[0041] The effect of this operation gestalt is explained using drawing 4 . Drawing 4 (a) shows the stray light from the objective lens 6 in case a stage 1 is search within the limits.

[0042] Since a stage position is search within the limits which the speculum person set up and it is almost close to a focus position, a stray light output does not change mostly with a true focus position. On the other hand, drawing 4 (b) shows the stray light from the objective lens 6 when the stage 1 has separated from the search range.

[0043] Thus, since distance until the reflected light of a stage 1 or slide glass carries out incidence to an objective lens 6 is long when the relative distance of an objective lens 6, a stage 1, or a photographic subject S is long, the power of the light of the reflected light decreases and the stage 1 which carries out incidence to an objective lens 6 as a result, or the indoor lighting light reflex quantity of light from a photographic subject S decreases.

[0044] That is, the stray light besides the search range cannot be made into the stray light in a focus position. Therefore, in case the stray light is detected, it is necessary to carry out in the stage position more near a focus position.

[0045] With this operation form, in order to ensure stray light detection, at the time of AF of a search out-of-range shell, control which performs stray light detection at a search range edge is performed. Therefore, by performing such control, the automatic-focusing detection equipment of this operation form becomes possible [carrying out stray light detection from every position of a stage], and high-speed and highly precise AF control of it is attained.

[0046] Next, with reference to the flow chart shown in drawing 5 , the microscope automatic-focusing detection equipment concerning the 3rd operation form is explained. Since the composition of this operation form is the same as that of the 1st operation form mentioned above, the explanation about composition is omitted and stray light warning operation used as the feature is explained. Moreover, in this operation form, the same step number is given to the same operation as the 1st operation form, and detailed explanation is omitted.

[0047] First, if the start of AF operation is directed based on operation of an operator (Step S1), the excitation optical shutter 3 will be closed (Step S2). The level A of the stray light according [this excitation optical shutter 3] to a closed state is detected (Step S3).

[0048] And it compares with the predetermined value TH2 which defined the level A of the stray light beforehand (Step S31). As a result of this comparison, when the level A of the stray light is smaller, AF operation equivalent to AF operation of the 1st and 2nd operation form is performed.

[0049] that is, the excitation optical shutter 3 -- open -- carrying out (Step S32) -- the photographic subject picture signal B -- detecting -- the level A of the stray light, and difference with the photographic subject picture signal B -- C is taken This difference partial output C is compared with the predetermined value TH1, and when the difference partial output C is one or more TH(s), a double lump of a focus is performed. However, when the difference partial output C is one or less predetermined value TH, after a photographic subject is judged that there is nothing to near and performs a photographic subject search, a double lump of a focus is performed (Step S33).

[0050] However, by the judgment of Step S31, when the level A of the stray light is over the predetermined value TH2 (YES), a speculum person is notified of there being a possibility that drive pronunciation members, such as a warning buzzer built in the external controller, (Step S34), and AF precision may fall since the stray light is too large to a speculum person.

[0051] In order that a speculum person may operate AF control normally according to AF operation by this operation gestalt, it becomes possible to deal with making indoor lighting light dark etc., and it becomes possible to make the environment where always high-speed and highly precise AF control is made to perform to automatic-focusing detection equipment.

[0052] Although notified of warning in acoustic sense with this operation gestalt, using a pronunciation member as a method of warning a speculum person, the same effect can be acquired even if it warns this visually using light-emitting part material, such as Light Emitting Diode.
[0053] moreover, the difference of the stray light and a photographic subject image -- although the photographic subject image is detected on the occasion of detection after detecting the stray light previously, since a photographic subject image is previously detected for this, the same effect can be acquired even if it performs stray light detection
[0054] Furthermore, especially with this operation gestalt, although only fluorescence observation is described, even if it uses this for other specula, for example, incident light dark field observation, the same effect can be acquired because of the same optical composition.
[0055] this invention of the deformation and application various in the range which are not limited to the example mentioned above and do not deviate from the summary of invention to others being possible is natural. Although the above operation gestalt was explained, the following invention is also included in this specification.
[0056] (1) An objective lens and the stage loading the sample used as a photographic subject, The image formation optical system to which image formation of the photographic subject is carried out through the aforementioned objective lens, and the light source for excitation light which irradiates excitation light to a photographic subject, The excitation optical shutter which forbids irradiating the aforementioned excitation light at a photographic subject, and the found the integral type image pck-up sensor which changes the light figure from the aforementioned image formation optical system into an electrical signal, An operation means to calculate a photographic subject's degree of focus according to the output from the aforementioned found the integral type image pck-up sensor, The focus control means controlled to make the aforementioned stage drive from the degree information of photographic subject focus by the aforementioned operation means, and to lead a photographic subject to a focus position, A stray light output means to perform for a photographic subject closing an excitation optical shutter for the so-called stray light detection which a surrounding lighting light etc. inputs into a sensor as a light figure through an objective lens etc. by not irradiating excitation light, and to output, an excitation optical shutter -- opening -- the stray light which takes the difference from the sensor output and stray light detection means at the time the bottom -- difference -- an output means and the time of AF control -- the aforementioned stray light -- difference -- the automatic-focusing detection equipment for microscopes characterized by having AF control adjustable means which carries out adjustable [of the AF control] according to the output of an output means
[0057] According to the aforementioned (1) term, it considered as the composition which interlocks AF system and an excitation optical shutter, and carried out adjustable [of the AF control] according to the difference of the output when opening the output and excitation optical shutter at the time of once closing an excitation optical shutter, before performing AF control, and closing an excitation optical shutter wide.
[0058] Therefore, it becomes distinguishable [the stray light and a photographic subject image], and high-speed and highly precise focus control is attained.
(2) When the aforementioned AF control adjustable means has large difference partial output A photographic subject recognizes it as it being in near, and the so-called fine mode in which a double lump of a focus is performed is controlled. when difference partial output is small a photographic subject -- searching -- being the so-called -- search mode -- control -- carrying out -- search mode -- **** -- the stray light -- an output -- a means -- an output -- obtaining -- having had -- integration -- a cycle -- being short -- the reset time -- a search -- carrying out -- things -- the feature -- ** -- having carried out -- the above -- (-- one --) -- a term -- a publication -- a microscope -- ** -- automatic focusing -- detection -- equipment .
[0059] According to the aforementioned (2) term, it considered lengthening the reset time of a sensor superfluously by the stray light at the time of a search as the control to forbid. Therefore, a sample search becomes high-speed and the high-speed focus control which stopped tenebrescence is attained.
[0060] (3) A search entry means by which the range which searchs a photographic subject beforehand can be set as the aforementioned (1) term in the automatic-focusing detection equipment for microscopes of a publication, A high-speed stage move means to drive a stage to a search range edge at high speed when the search out-of-range shell AF set up with the aforementioned search entry means is started, after arriving at a search range edge by the aforementioned high-speed stage move means -- a stray light output means and the stray light -- difference -- the automatic-focusing detection equipment for microscopes given in the aforementioned (1) term or (2) terms which are characterized by performing an output means and AF control adjustable means
[0061] According to the aforementioned (3) term, in the system which sets up the range which searchs a sample beforehand, it was once made to carry out stray light level detection by the excitation optical shutter at a search range edge to the during starting of AF of a search out-of-range shell.
[0062] Therefore, since the stray light in the position near a focus position is detectable, the reliability of stray light level improves. Therefore, highly precise AF becomes possible.
(4) Automatic-focusing detection equipment for microscopes given in the aforementioned (1) term characterized by having the stray light warning means which emits warning to a user by the aforementioned stray light output means when a stray light output is beyond a predetermined value.
[0063] According to the aforementioned (4) term, if the level of the stray light exceeds a predetermined value, warning will be emitted to a speculum person. It becomes possible [that this drops indoor lighting light on a speculum person etc.] to recommend to lower stray light level. Therefore, highly precise AF control can be performed.

[0064]
[Effect of the Invention] As explained in full detail above, according to this invention, AF control in fluorescence observation or an incident light dark field speculum can be performed at high speed and with high precision, the tenebrescence of the photographic subject at the time of fluorescence observation is stopped to the minimum, and the automatic-focusing detection equipment for microscopes which can be included in an automatic-check system can be offered.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

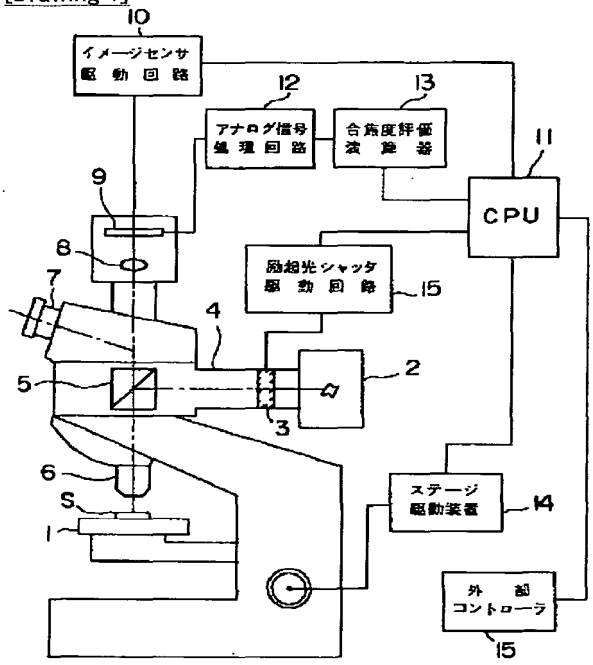
[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the rough composition of the automatic-focusing detection equipment for microscopes concerning the 1st operation gestalt.
[Drawing 2] It is a flow chart for explaining an operation of the 1st operation gestalt.
[Drawing 3] It is a flow chart for explaining the microscope automatic-focusing detection equipment concerning the 2nd operation gestalt.
[Drawing 4] It is drawing of a ****** sake about the effect of the 2nd operation gestalt.
[Drawing 5] It is a flow chart for explaining an operation of the 3rd operation gestalt.
[Drawing 6] In order to explain the stray light, it is drawing having shown the optical path of a microscope.
[Description of Notations]
1 -- Stage
2 -- Mercury-vapor lamp
3 -- Excitation optical shutter
4 -- Incident light fluorescence floodlighting pipe
5 -- Cube corner reflector
6 -- Objective lens
7 -- Ocular
8 -- Image formation lens
9 -- Image sensors
10 -- Image-sensors drive circuit
11 -- CPU
12 -- Analog processing circuit
13 -- The degree evaluation computing element of focus
14 -- Stage driving gear
15 -- Excitation optical shutter drive circuit
S -- Photographic subject

[Translation done.]

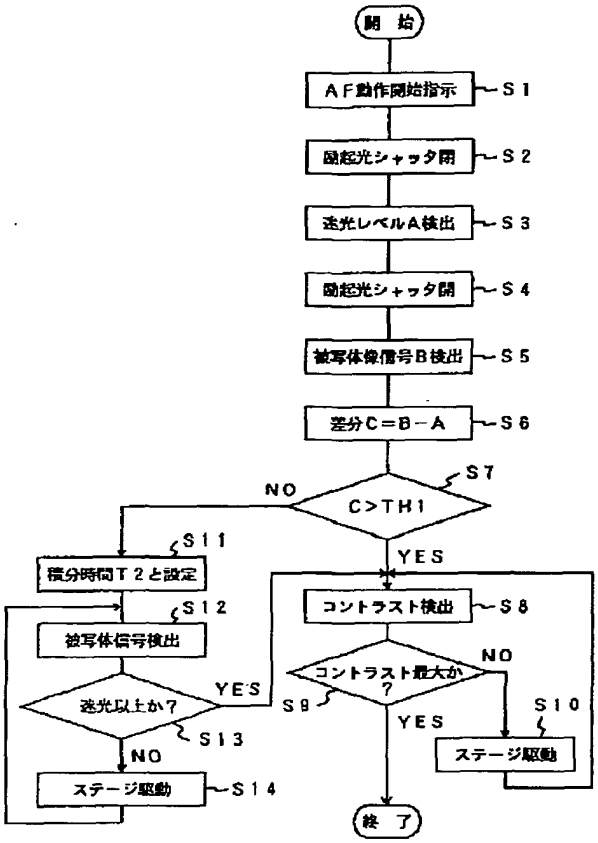
* NOTICES *

DRAWINGS

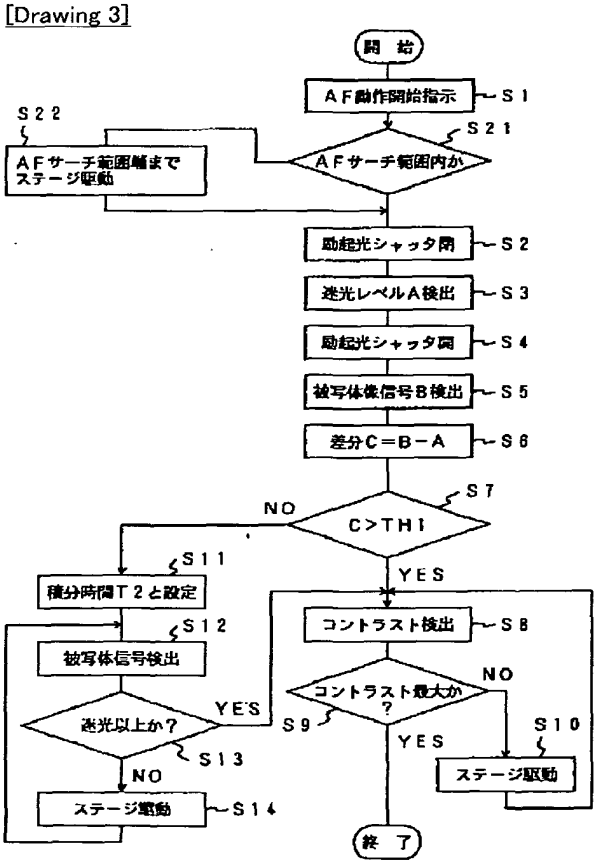
[Drawing 1]



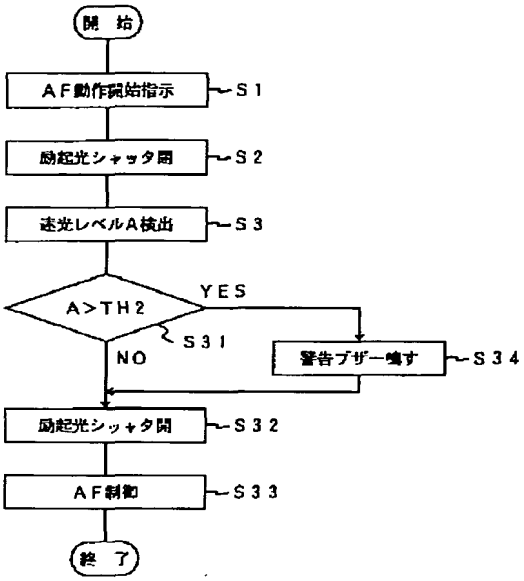
[Drawing 2]



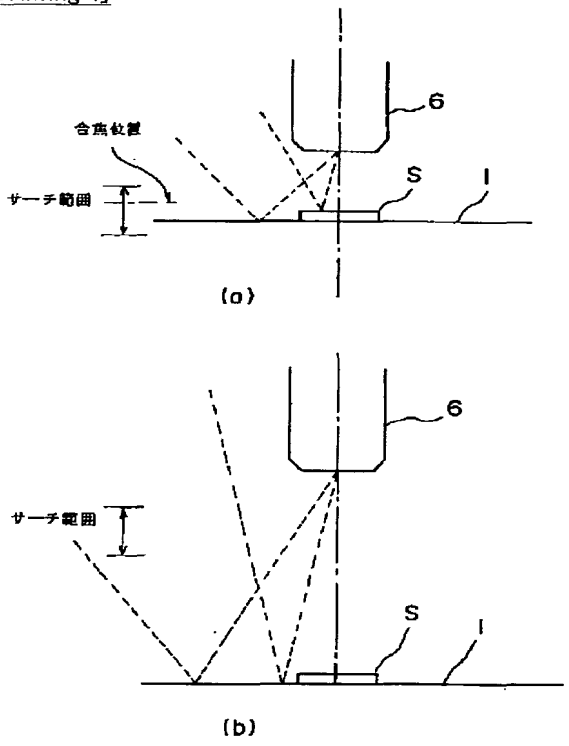
[Drawing 3]



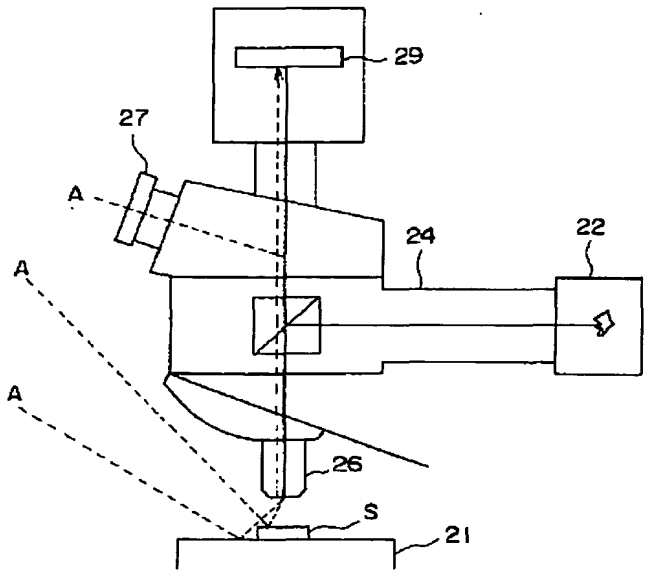
[Drawing 5]



[Drawing 4]



[Drawing 6]



[Translation done.]